

Here all similarity ends...

from this point on, it's craftsmanship!



Bliley
CRYSTALS

THE COMPANY

From a modest beginning in 1930 the Bliley organization has built an international reputation for production of fine quartz crystals and associated devices used for frequency control application. This progress was based on steadfast adherence to fundamental principles of quality and crafts-

manship which gradually set the standard of comparison. Today Bliley crystals are used in every branch of electronics where dependable and accurate frequency control is desired. This accolade of acceptance is your best assurance of satisfaction when you specify Bliley crystals.

THE PRODUCT

The Bliley crystal units shown in this catalog are a direct result of consistent engineering effort on research and development. Bliley has pioneered many original designs and processes which have contributed substantially to precision frequency control as employed in modern electronic equipment. One outstanding example is the patented "acid-etch" process which prevents frequency change due to aging. This basic quality feature is only one of numerous other advantages in design

that constitute hidden plus-factors in all Bliley products. The crystals listed in this catalog are produced under one or more of the following Bliley patents: 2079540—2240451—2157808—2467353—2364501—2213031—2256931—2240453—2284968—other patents pending. Bliley crystal units are also licensed under the United States Patents of American Telephone and Telegraph Company and Western Electric Company.

SPECIAL INFORMATION

Crystal holders shown in this catalog are designated only by Bliley type numbers used in commercial application. Many holders such as types MC9, SR5, BH6, BH7 and AR23W meet JAN specifications as used by the National Military Establishment. When such holders are furnished with crystals that meet JAN performance and inspection requirements the complete crystal unit is then supplied under a JAN type number. An-

other group of holders, when furnished with crystals that meet CAA requirements, can be supplied with the CAATC designation for airline application. Since specifications may vary widely, depending upon the application involved, price quotations are normally submitted only on request. Price information on a group of General Purpose Crystals produced to standard stock specifications is included herein for use where applicable.

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WHEN ORDERING CRYSTAL UNITS OR REQUESTING QUOTATIONS, THESE POINTS ARE IMPORTANT FOR PROPER ANALYSIS OF YOUR REQUIREMENTS

1. HOLDER TYPE—Refer to chart for available holder types.
2. FREQUENCY CHARACTERISTICS—Refer to characteristic curves illustrating frequency stability available in your frequency range.
3. FREQUENCY ACCURACY—Furnish diagram of your oscillator. If practicable, employ a model oscillator.
4. CRYSTAL ACTIVITY—Where feasible indicate grid current requirements on your oscillator diagram or model oscillator.
5. FREQUENCY STABILITY—Specify your requirements in terms of percentage tolerance and state the ambient temperature range which will be encountered in service.
6. OSCILLATOR CONSIDERATIONS become increasingly important above 30 mc. In crystal applications above this range, make use of Bliley Engineering Service for oscillator recommendations.

TYPE

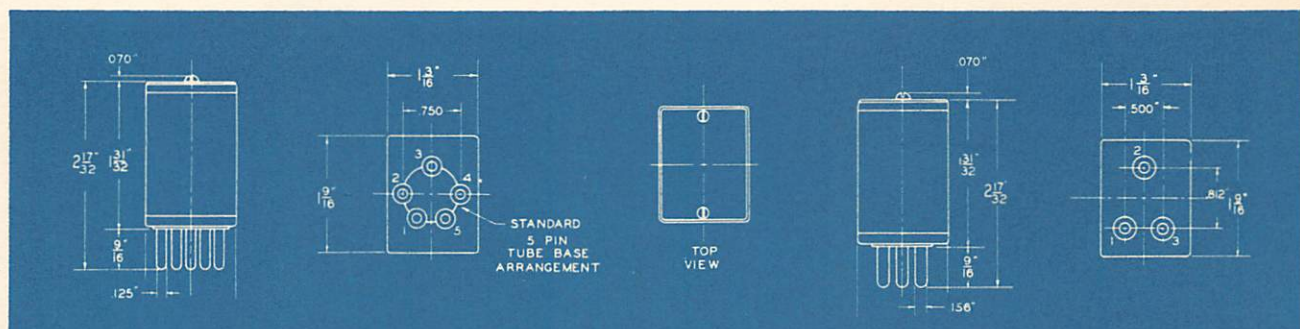
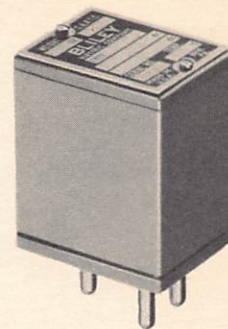
AR5W

FREQ.

**Dual 1700—11,000 kc
Single 350—1700 kc**

Compact unit supplied with 2 crystals anywhere in the frequency range from 1700 to 11,000 kc for transceiver equipment. Molded phenolic case, brass

nickel plated pins. Excellent mechanical and electrical stability over wide range of service conditions. Rigidly clamped crystal provides stability when subject to vibration and impact. CAA type certificated for use in air carrier equipment in frequency range 2 to 5 mc. For single crystal specify AR4W. If 5 pin base is desired, specify AR4 or AR5. For a frequency range from 350 to 1700 kc the fixed air gap type mounting is used and is available with single crystal only.

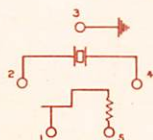
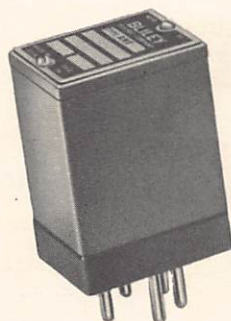


TYPE

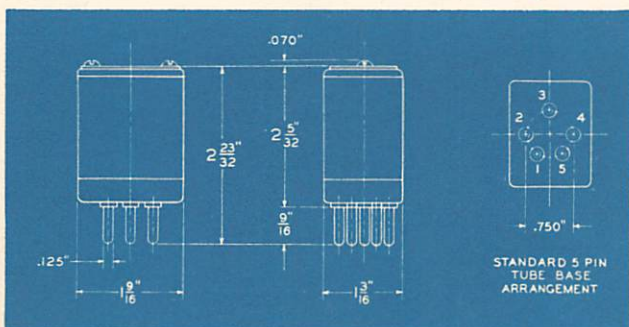
ART

FREQ.

800—12,000 kc



Constant temperature oven and crystal assembly in compact case. Heater current .85 ampere at 6.3 volts. Stabilizes crystal temperature at 75°C for close tolerance requirements in VHF services.

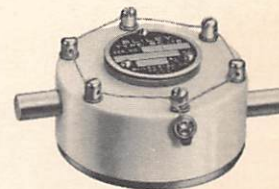


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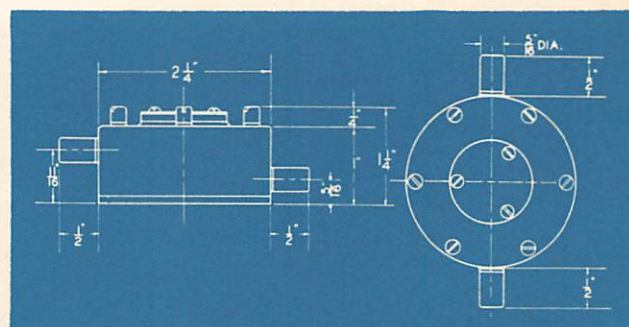
BC10

FREQ.

200—5000 kc



Precision holder employs micrometer screw control of upper crystal electrode for frequency adjustment after installation. For use in fixed equipment such as broadcast monitors and frequency standards.



TYPE

FM6

FREQ.

70—350 kc



TYPE

KV3

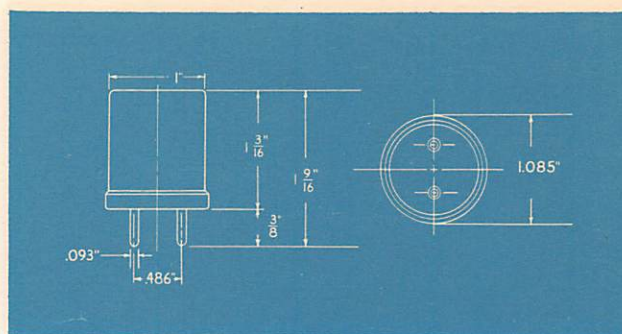
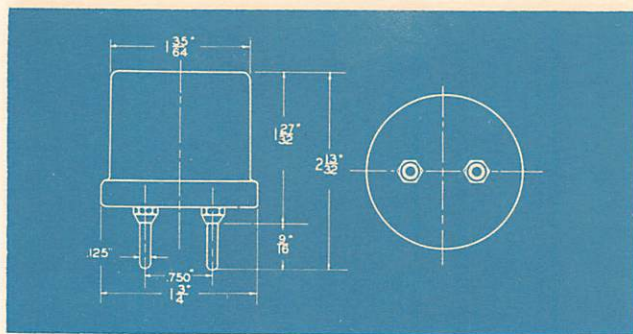
FREQ.

100—600 kc



Plated crystal rigidly clamped between resonant pins provides exceptional electrical and mechanical stability. Captive gasket seals case effectively for any service. For all applications requiring a precision source of low frequency in this range.

Utilizes plated crystal with wire supports which are soldered to the plated surfaces. Suggested for use in signal generators and secondary standards. Special unit at 100 kc is available with complete circuit information.



TYPE

MC7

FREQ.

600—11,000 kc

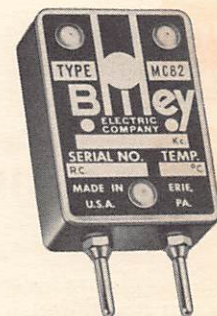


TYPE

MC85

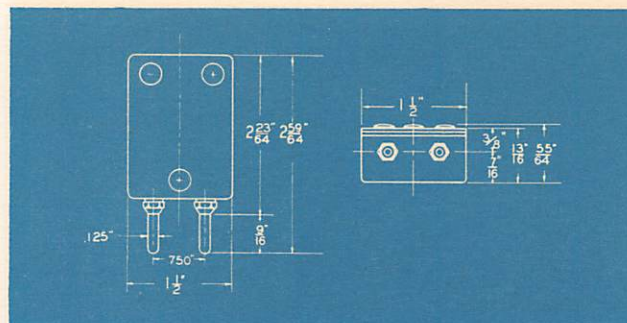
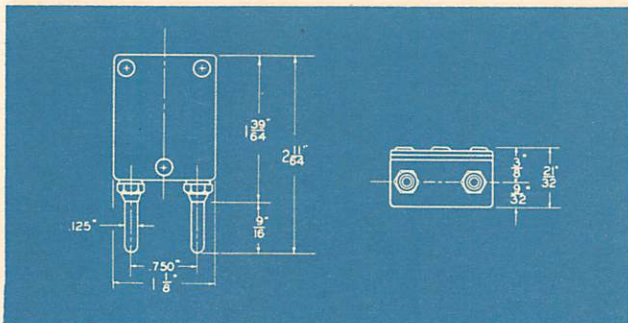
FREQ.

350—600 kc



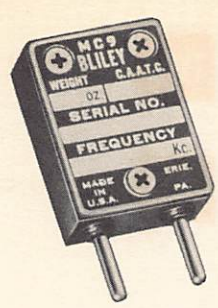
Gasket sealed holder. Ideal for multi-channel applications. Accommodates quartz plates up to .7" x .9" for adequate activity in medium power circuits. Used widely in marine radio telephone and emergency service applications. Fixed air gap assembly used from 600 to 1700 kc, pressure air gap from 1700 to 11,000 kc.

Uses fixed air-gap assembly with unclamped crystal. Glass spacers maintain relative position of electrodes. Holder accommodates quartz plate 1" x 1" for maximum activity.

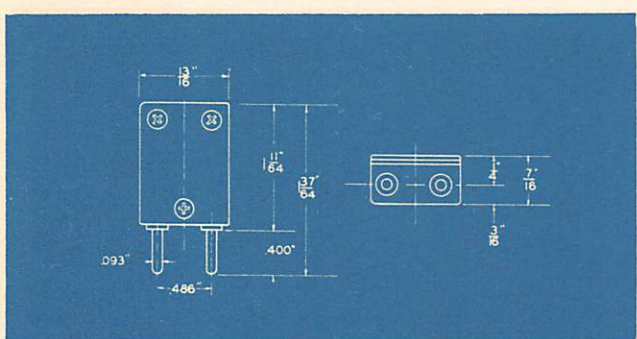


TYPE **MC9**

FREQ. **2500—60,000 kc**

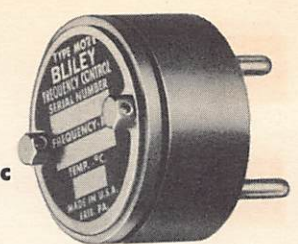


Compact holder for multi-channel portable equipment where space is a factor. Gasket sealed against moisture and humidity. Suggested for all vehicular and air-borne equipment. CAA type certificated in frequency range 3 to 11 mc for use in commercial air-carrier equipment.

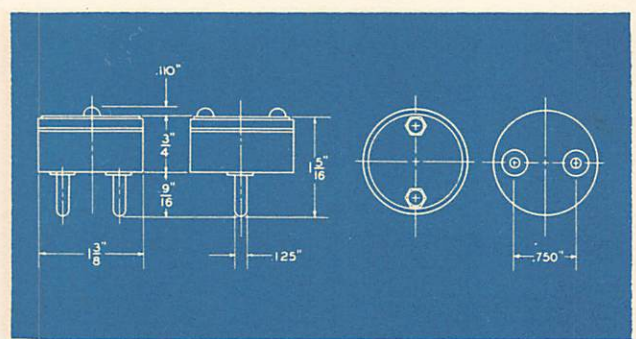


TYPE **MO21**

FREQ. **1700—11,000 kc**

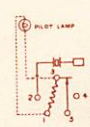


Flat holder is gasket sealed for dependable service. Excellent mechanical and electrical stability. Successor to Bliley type MO2 for general service.

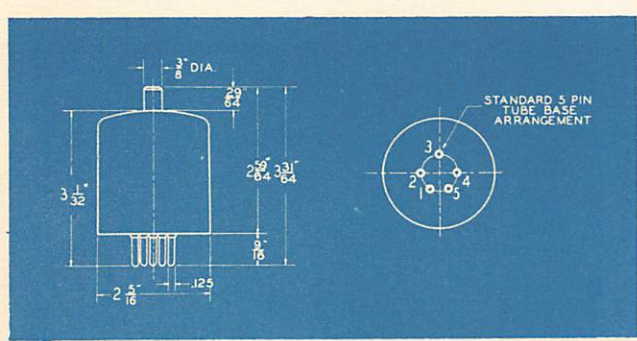


TYPE **MO3**

FREQ. **540—11,000 kc**

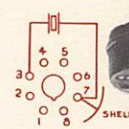
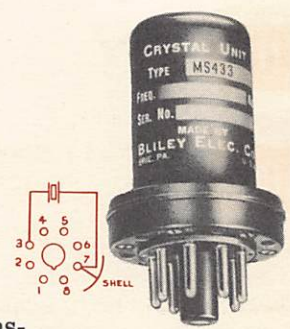


Constant temperature crystal oven combined with crystal assembly. Heater current 1 amp. at 6.3V. Compact unit provides temperature stability for maintenance of close tolerances in point to point communication. Specify type MO3AB for FCC approved unit in standard broadcast range.

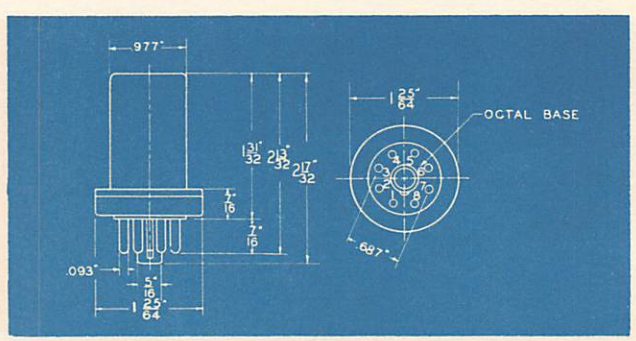


TYPE **MS433**

FREQ. **1000 kc**

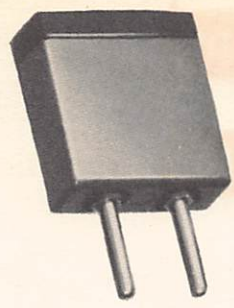


High precision crystal assembly sealed in metal tube envelope. Frequency within ± 15 cycles at 20°C when used in recommended oscillator. Will maintain frequency within 60 cycles between 0°C and 50°C. Designed for use in frequency meters.

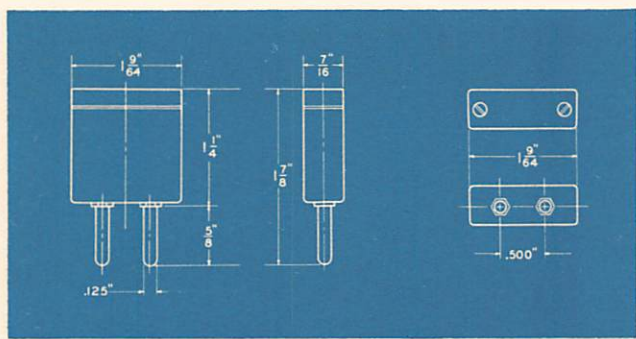


TYPE **SR5**

FREQ. 600—15,000 kc

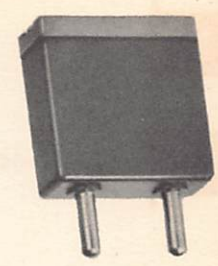


Case is molded phenolic gasket sealed at all openings for maximum protection. Suggested for multi-channel operation in air-borne equipment. CAA type certificated for use in commercial aircraft from 2 to 11 mc.

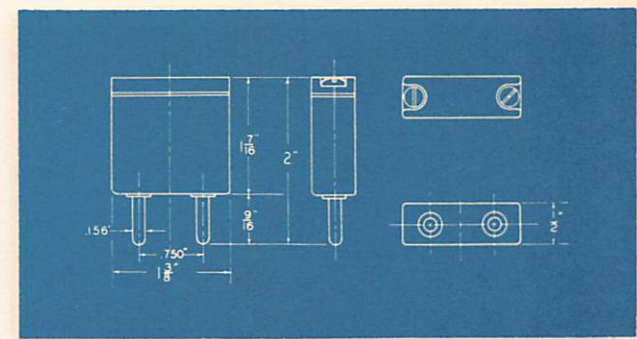


TYPE **SR6**

FREQ. 1700—11,000 kc

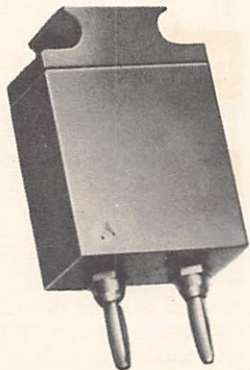


Pressure air-gap crystal assembly in gasket sealed phenolic case. Accommodates $.750$ " x $.750$ " quartz plate for adequate activity with medium power tubes and circuits, particularly low frequency range. Suggested for all mobile applications.

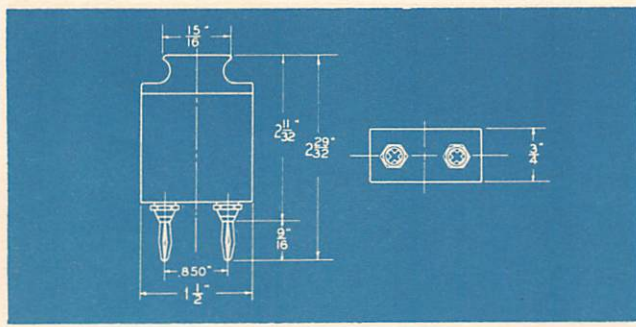


TYPE **SR7**

FREQ. 1700—11,000 kc

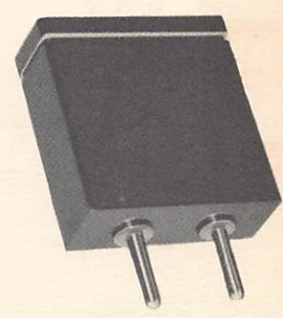


Heavy duty holder equipped with banana plug connections. Pressure air-gap crystal assembly provides excellent mechanical stability. Fully protected by gasket seals at all case openings. Recommended for marine use and similar applications.

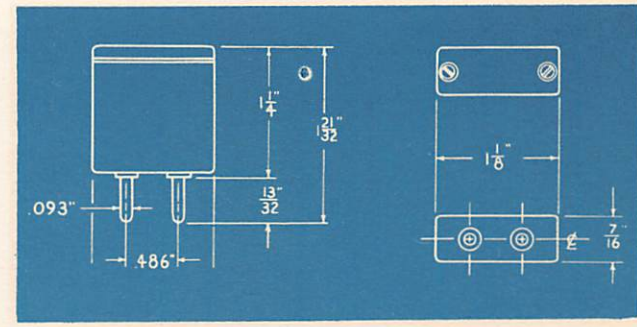


TYPE **SR8**

FREQ. 600—15,000 kc



Gasket sealed case molded of phenolic low moisture absorption material provides complete protection. Advantageous where design dictates wide frequency coverage with one crystal holder.



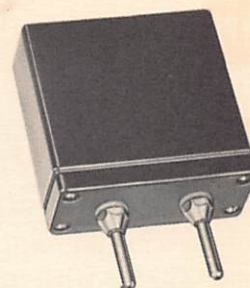
TYPE SR10

FREQ. 200-600 kc
1-100 mc



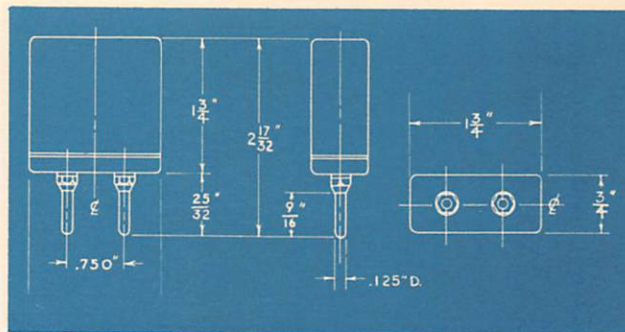
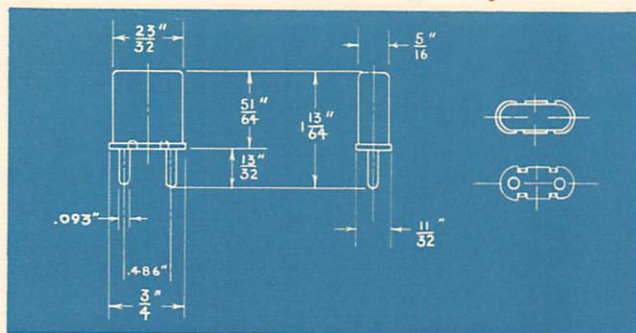
TYPE SR12

FREQ. 70-200 kc



Nickel silver cap crimped on a molded phenolic base. Rugged internal assembly designed for optimum performance in frequency range specified. Ideally suited for applications where size and weight are important factors. Specify type SR11 if .050" diameter pins spaced .486" on centers are required. See type TCO-1 & 2 for temperature control used with SR10 and SR11.

This holder designed specifically for use with plated low drift crystal in specified range. Internal assembly employs wire supports soldered directly to plated surface of quartz crystal. Case is molded phenolic and gasket sealed.



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PACKAGED FREQUENCY CONTROL WITH CUSTOM BUILT OSCILLATORS

Bliley is now prepared to design and build packaged oscillators for precision V.H.F. applications between 20 and 200 mc. Consistent performance of overtone crystals and maintenance of operating tolerances to $\pm .005\%$ or better over wide temperature ranges is assured by consideration of all significant factors in a package of this kind. The result is a precise frequency source that has sufficient power to meet design ratings.

Space requirements in the equipment will determine whether a subchassis or plug-in unit is most desirable.

Complete uniformity of construction and careful control of component tolerances assures satisfactory performance.

This custom service is limited to applications requiring production quantities. Inquiries on your company letterhead are invited.

GENERAL PURPOSE CRYSTALS

Application	Type	Frequency	Tolerance	Price
Ship-to-Shore	MC7	2-3.5 mc	$\pm .02\%$	\$ 6.00
	SR5	2-3.5 mc	$\pm .02\%$	6.00
	SR8	2-3.5 mc	$\pm .02\%$	6.00
Signal Gen. Marker	MC9	5000 kc	$\pm .02\%$	2.80
Private Aircraft	MC9	3105 kc	$\pm .02\%$	5.50
T. V. Markers	SR10	16-20 mc	$\pm .05\%$	7.95
FM—i.f. MARKER	MC9	10.7 mc	$\pm .05\%$	3.95
Standard Frequencies	MS433	1000 kc	$\pm .005\%$	17.00
	KV3	100 kc	$\pm .005\%$	6.95
R. F. Generators	MC9	13,560 kc	$\pm .05\%$	5.50

GENERAL INFORMATION

The wide range frequency coverage in present day crystal units is made possible through the use of different cuts available. In many instances crystal units at the same frequency are available with different characteristics. To enable you to choose the crystal with characteristics most suitable for your application refer to the characteristic curves shown in this section.

The chracteristic curves illustrate frequency deviation in percent of nominal over wide ambient ranges and are indicative of crystal stability in production units. Curve C-1 is essentially linear over normal temperature ranges and may be either positive or negative. The controlling factor is the orientation of the crystal with relation to the axes in the mother quartz. Deviation from the optimum orientation as encountered in production are illustrated by the two curves showing extremes. Curves C-2, C-3, C-4 and C-6 are essentially parabolic with best frequency stability occurring at the peak of the curve. The peak of the curve is normally selected as the midpoint in the specified temperature range. When crystals of this type are operated in temperature controlled ovens they are oriented so that the peak of the curve occurs approximately at the oven operating temperature.

Crystal units are mechanical vibrating ele-

ments, driven by the a.c. field usually in the grid circuit of the oscillator. The amplitude of vibration is controlled by the oscillator drive. To prevent mechanical fracture of the quartz element it is recommended that the r.f. current through the crystal be limited to values as shown in the following table:

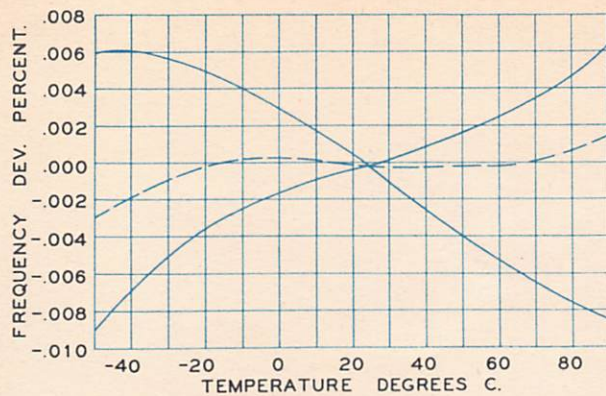
70-	300 kc	5 ma
301-	550 kc	10 ma
551-	1000 kc	25 ma
1001-	2000 kc	50 ma
2001-	5000 kc	75 ma
5001-	8000 kc	100 ma
8001-	10000 kc	125 ma

The limits shown above are maximum safe operating conditions. Crystal drive causes internal heating which results in frequency change due to temperature rise. Best stability is therefore obtained under low drive conditions.

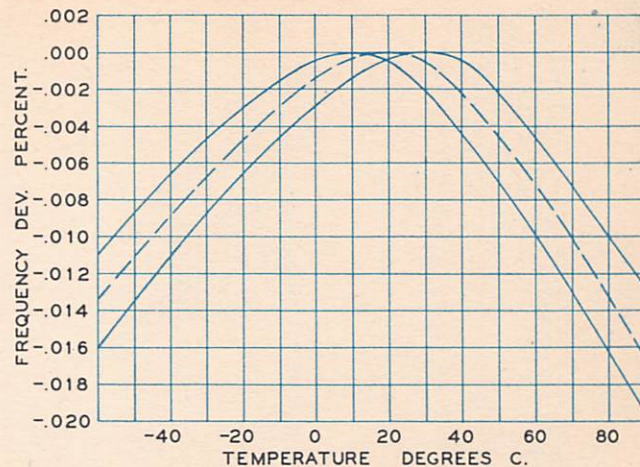
Crystals employing electrodes plated directly to their major surfaces and mounted with wires soldered to the plating are subjected to permanent frequency change, if used in high drive oscillators. For proper operation of these types which include KV3, SR9 and SR12 we recommend that r.f. current values do not exceed those shown in the following table:

70-100 kc	3.75 ma
101-150 kc	2.5 ma
151-200 kc	2.0 ma
201-250 kc	1.5 ma
251-350 kc	1.0 ma
351-500 kc	.75 ma

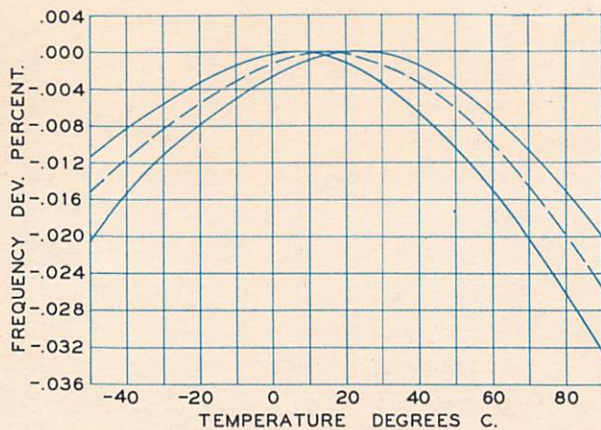
Frequency Range	Characteristics	Special Types
70 - 120 kc	C-4	FM6G
100 kc	C-5	
120 - 200 kc	C-3	
200 - 350 kc	C-6	FM6, BC 10, BC46T
200 - 350 kc	C-3	
350 - 600 kc	C-3	
350 - 600 kc	C-1	AR4, AR4W, BC 10, BC46T CF6
455, 465, 500 kc		
600 - 4000 kc	C-1	
4000 - 15000 kc	C-2	BH6, SR10, SR11, BH7 BH6, MC9, SR11, SR10, BH7, VX2 BH7, BH6, SR10, SR11
4000 - 20000 kc	C-2	
4000 - 60000 kc	C-1	
4000 - 100000 kc	C-1	



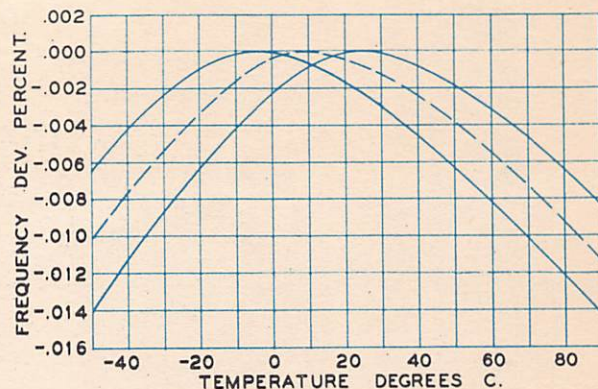
C-1



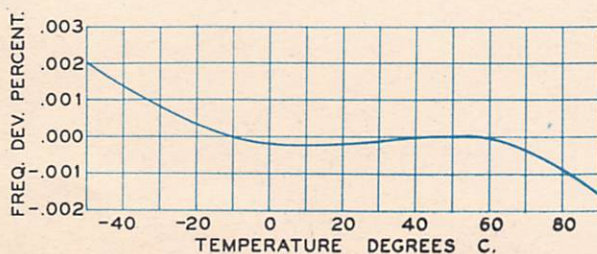
C-2



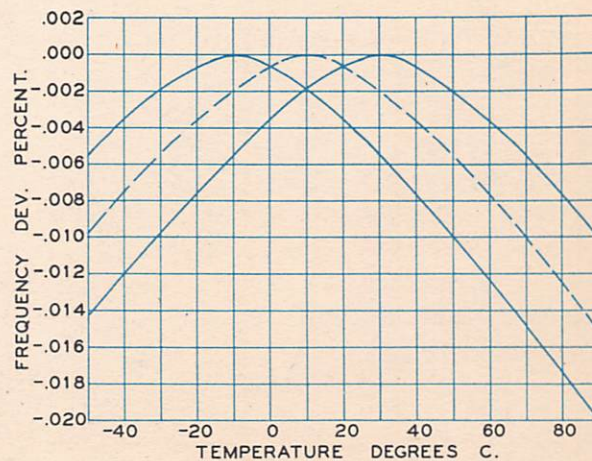
C-3



C-4



C-5



C-6

